SUB-FOSSIL TERMITE MOUNDS IN THE SIMPSON DESERT

L.R. Miller
Division of Entomology, CSIRO,
GPO Box 1700,
CANBERRA ACT 2601

Introduction

Termite fossils of any kind are not abundant, but the recent discovery of excellently preserved whole adults of the family Termopsidae (Ruiz and Delclos 1986) indicate that the order Isoptera was well differentiated by the early Cretaceous. Later fossils consist mainly of wings or fragments of wings (Emerson 1965), although there are some whole insects from Tertiary amber (Carpenter and Hermann 1977, Krishna and Bacchus 1987). Trace fossils (ie. fossilised nests, galleries, etc) are even more scarce. Cloud *et al* (1980) stated that galleries in Precambrian rocks in Africa, first thought to be the earliest metazoan trace fossils, were probably caused by termites and were of much more recent, but unknown, age. Coaton (1981) reported fossil termite nests, probably of a species of *Microhodotermes*, from South Africa which were carbon dated at 32,100 + 720 years B.P.. Fontes (1984) discussed termite galleries in lateritic and bauxitic soils in the Amazon region, to which he attributed an age of 12,000-18,000 years B.P.. This paper records late Pleistocene termite mounds from the sand dunes of the Simpson Desert in Central Australia.

Description of Mounds

The sand ridges of the Simpson Desert are parallel longitudinal dunes 12-30m high, which extend unbroken for tens or sometimes hundreds of kilometres (Brown *et al*. 1968). The dunes are relatively stable (Galloway and Kemp 1981) and have been formed by a series of depositions over at least 250,000 years (Gardner *et al* 1987). Disturbance, for example construction of a road or track across or along the edge of a dune, may initiate erosion resulting in one or more of the deposition layers being removed by wind.

In 1986 I examined two sites near the southeast edge of the Simpson Desert at which the relatively soft upper layers of dunes had been eroded away, exposing a firmer, more cohesive surface. On this newly exposed surface were earthy structures, also eroded to varying degrees, which were undoubtedly fossil termite mounds. The mounds ranged in size from 30-60 cm diameter and 15-17 cm in height. Galleries consisting of broad flattened chambers connected by narrow tunnels were clearly visible on the eroded outer parts of the mounds (Fig. 1), but the

inner chambers were completely filled with sand grains so that the gallery structure was not easily seen. However, since grain size of the fill was larger than that of the walls, and grains were not cemented together, overall gallery structure was faintly visible and the sand fill could be removed by gentle brushing. I suggest that sand infiltrating the gallery system as the mounds were buried would have preserved their structure by preventing them from being crushed as the weight of the upper dune layers increased.

At one of the sites examined, near Innamincka, an eroded area approximately 20 m x 40 m contained seven mounds. The second, much smaller, area forming part of a road edge contained one mound. Dr R. Wasson, a scientist with extensive knowledge of the dune formations, has informed me that he has noted mounds in eroded dunes in other parts of the Simpson Desert.

Age of Mounds

The soils comprising the lower layers of the dunes contain carbonate nodules which can be radiocarbon dated to give a minimum age for the soil in which they occur. The mounds also contain carbonate and the degree of development of the nodules in a section of mound taken to CSIRO laboratories in Canberra is consistent with that of a dune layer dated at a minimum age of 13,000 - 25,000 years B.P. (R. Wasson, pers. comm.).

Even if no information were available for the age of the dunes, the high concentrations of carbonate indicate the antiquity of the mounds. This is because the formation of carbonate concretions in mounds is pedological not biological, and would take hundreds or thousands of years (Lee & Wood 1971).

It should also be noted that since nodules have formed both in the clayey fabric of the mound structure and in the sand which fills the galleries, age therefore refers to the age of the layer which buried the mounds, and not that of the surface upon which they were constructed.

Identification of the Mounds

The diameter and shape of the chambers and tunnels which make up the gallery systems of the mounds are very similar to those constructed by species of the genus *Drepanotermes* Silvestri. The Australian National Insect Collection has no record of *Drepanotermes* from the Simpson Desert, but two mound-building species, *D. rubriceps* (Froggatt) and *D. perniger* (Froggatt), are found close to its margins. The gallery structure of the sub-fossil mounds resembles most closely that of *D. perniger* (*cf* Watson and Perry 1981).

Species of *Drepanotermes* are harvesters which forage on the surface, collecting grass and other plant material and storing it within their nest systems. Although a wide range of material is known to be collected, including acacia phyllodes, leaves,

Fig. 1. *Late Pleistocene termite mound. Gallery structure is clearly visible in this recently eroded surface.*

seeds, and twigs, the type of material eaten depends on availability and the preferred food of almost all of the twenty-three known species is grass (Watson and Perry 1981). Given the high density of fossil mounds (up to 125ha-1), it seems reasonable to assume that at the time *D. perniger* or a closely related species inhabited the area, the landscape included substantial areas of grassland comprised of species palatable to *Drepanotermes*.

The present vegetation consists of stunted Acacia and ephemeral herbs, with sparse grasses. The dune vegetation of the Simpson Desert is known to have fluctuated widely during the Pleistocene due to climatic change, and the age of the fossil mounds is consistent with a time of high rainfall conducive to the formation of grassland (Galloway & Kemp 1981).

Acknowledgement

I thank Dr R. Wasson (CSIRO Division of Water Resources, Canberra) for his information on dune structure and age.

Literature Cited

BROWN, D.A., CAMPBELL, K.S.W., and CROOK, K.A.W. 1968. *The geological evolution of Australia and New Zealand.* Pergamon Press, Oxford.

CARPENTER, F.M. and HERMANN, H.R. 1979. Antiquity of sociality in insects. *In* Hermann, H.R. *Social Insects*, Vol. 1, pp 81-89.

CLOUD, P., GUSTAFSON, L.B. and WATSON, J.A.L. 1980. The works of living social insects as pseudofossils and the age of the oldest known Metazoa. *Science* 210:1013-1015.

COATON, W.G.H. 1981. Fossilised nests of Hodotermitidae (Isoptera) from the Clanwilliam district, Cape Province. *J. Ent. Soc. Sth. Afr.* 44:79-81.

EMERSON, A.E. 1965. A review of the Mastotermitidae (Isoptera), including a new fossil genus from Brazil. *Am. Mus. Nov.* No. 2236 1-46

FONTES, L.R. 1984. Sinais fósseis daáço de cupins. *Ciência Hoje.* 2:52-56.

GALLOWAY, R.W. and KEMP, E.M. 1981. Late Cenozoic environments in Australia. In Keast, A. (Ed.) *Ecological biogeography of Australia.* W. Junk, The Hague.

GARDNER, G.J., MORTLOCK, A.J., PRICE, D.M., REDHEAD, M.C. and WASSON, R.J. 1987. Thermoluminescence and radiocarbon dating of Australian desert dunes. *Aust. J. Earth Sciences* 34:343-357.

LEE, K.E. and WOOD, T.G. 1971. *Termites and Soils.* Academic Press, London.

KRISHNA, K. and BACCHUS, S. 1987. A new fossil species of termite from Dominican Amber, *Cryptotermes yamini* (Isoptera, Kalotermitidae). *Am. Mus. Novitates* 2884: 1-5.

RUIZ, A.L. and DELCLOS, X.M. 1986. *Meiatermes*, neuvo genero fósil de insecto Isóptero (Hodotermitidae) de las calizas Neocomienses del Montsec (Provincia de Lérida, Espana). *Institut d'estudis ilerdencs*, pp 1-65.

WATSON, J.A.L. and PERRY, D.H. 1981. The Australian harvester termites of the genus *Drepanotermes* (Isoptera : Termitinae). *Aust. J. Zool. Suppl. Ser.* No. 78:1-153.